

IN THE CLAIMS

1. Air conditioning system for a motor vehicle, which is designed for an air conditioning operating mode and at least one other operating mode in the form of at least one of a heat pump operating mode and a reheat operating mode, said air conditioning system comprising:

a refrigerant cycle with a compressor, a refrigerant cooler and a supply air/refrigerant heat exchanger, said supply air/refrigerant heat exchanger being disposed in a supply air channel and functioning as an evaporator in an air conditioning operating mode,

a coolant cycle for cooling a heat generating vehicle component,

a refrigerant/coolant heat exchanger, coupling the refrigerant cycle and the coolant cycle so as to transfer heat,

refrigerant flow control valves for controlling mode-dependent flow of the refrigerant so as to be guided in an air conditioning mode from the compressor over the refrigerant cooler to the supply air/refrigerant heat exchanger, and

an internal combustion engine exhaust gas/coolant heat exchanger connected upstream in series to the refrigerant/coolant heat exchanger in the coolant cycle.

2. Air conditioning system for a motor vehicle according to claim 1,

wherein said at least one other operating mode includes a reheat operating mode, in which the refrigerant flow control valves guide refrigerant flow from the compressor at least in part to the refrigerant/coolant heat exchanger, functioning as the condenser/gas cooler in this operating mode, and from there to the supply air/refrigerant heat exchanger, functioning as the evaporator in this operating mode, and

wherein the refrigerant/coolant heat exchanger is connected upstream in series on the coolant side to a supply air/coolant heat exchanger disposed in the supply air channel.

3. Air conditioning system according to claim 1, wherein said refrigerant flow control valves include:

a 4 way valve which is connected with a first connection to the compressor output side, with a second connection directly or indirectly to the compressor inlet side and with a third connection to the supply air/refrigerant heat exchanger, and

a 3 way valve which is connected with a first connection with a fourth connection of the 4 way valve, with a second connection to the refrigerant cooler and with a third connection to the refrigerant/coolant heat exchanger.

4. Air conditioning system according to claim 1, wherein the refrigerant cycle includes a refrigerant high pressure-sided accumulator with an assigned check valve arrangement operably

connecting the accumulator to the supply air/refrigerant heat exchanger, the refrigerant cooler and the refrigerant/coolant heat exchanger.

5 5. Air conditioning system according to claim 1, wherein the refrigerant cycle includes:

10 a refrigerant low pressure-sided accumulator, and  
15 an internal heat exchanger which is arranged on a low pressure side between the accumulator and the compressor and on a high pressure side is connected, on the one hand, to the supply air/refrigerant heat exchanger, and, on the other hand to the refrigerant cooler and the refrigerant/coolant heat exchanger.

20 6. Air conditioning system according to claim 1,  
comprising a supply air conveying unit which exhibits two operating modes with opposite supply air conveying directions at the supply air channel, and

25 wherein the air conditioning system is designed for carrying out a drying operating mode, in that the supply air conveying unit conveys drying air for drying the supply air/refrigerant heat exchanger in the air conveying direction, reversed to the supply air conveying direction leading into the vehicle interior, past the supply air/refrigerant heat exchanger, whereby the drying mode is activated at least after shutdown of the vehicle in a previous air conditioning or reheat mode.

7. Air conditioning system according to claim 2,

comprising a supply air conveying unit which exhibits two operating modes with opposite supply air conveying directions at the supply air channel, and

5 wherein the air conditioning system is designed for carrying out a drying operating mode, in that the supply air conveying unit conveys drying air for drying the supply air/refrigerant heat exchanger in the air conveying direction, reversed to the supply air conveying direction leading into the vehicle interior, past the supply air/refrigerant heat exchanger, whereby the drying mode is activated at least after shutdown of the vehicle in a previous air conditioning or reheat mode.

10 8. Air conditioning system for a motor vehicle, which is designed for an air conditioning operating mode and at least one other operating mode in the form of at least one of a heat pump operating mode and a reheat operating mode, said air conditioning system comprising:

15 a refrigerant cycle with a compressor, a refrigerant cooler and a supply air/refrigerant heat exchanger, said supply air/refrigerant heat exchanger being disposed in a supply air channel and functioning as an evaporator in an air conditioning operating mode,

20 a coolant cycle for cooling a heat generating vehicle component,

a refrigerant/coolant heat exchanger, coupling the refrigerant cycle and the coolant cycle so as to transfer heat, and

5 refrigerant flow control valves for controlling mode-dependent flow of the refrigerant so as to be guided in an air conditioning mode from the compressor over the refrigerant cooler to the supply air/refrigerant heat exchanger,

10 wherein said at least one other operating mode includes a reheat operating mode, in which the refrigerant flow control valves guide refrigerant flow from the compressor at least in part to the refrigerant/coolant heat exchanger, functioning as the condenser/gas cooler in this operating mode, and from there to the supply air/refrigerant heat exchanger, functioning as the evaporator in this operating mode, and

15 wherein the refrigerant/coolant heat exchanger is connected upstream in series on the coolant side to a supply air/coolant heat exchanger disposed in the supply air channel.

9. An air conditioning system according to claim 8, wherein said refrigerant flow control valves include:

20 a 4 way valve which is connected with a first connection to the compressor output side, with a second connection directly or indirectly to the compressor inlet side and with a third connection to the supply air/refrigerant heat exchanger, and

a 3 way valve which is connected with a first connection with a fourth connection of the 4 way valve, with a second connection to the refrigerant cooler and with a third connection to the refrigerant/coolant heat exchanger.

5 10. Air conditioning system according to claim 8, wherein the refrigerant cycle includes a refrigerant high pressure-sided accumulator with an assigned check valve arrangement operably connecting the accumulator to the supply air/refrigerant heat exchanger, the refrigerant cooler and the refrigerant/coolant heat exchanger.

10 11. Air conditioning system according to claim 8, wherein the refrigerant cycle includes:

a refrigerant low pressure-sided accumulator, and

15 an internal heat exchanger which is arranged on a low pressure side between the accumulator and the compressor and on a high pressure side is connected, on the one hand, to the supply air/refrigerant heat exchanger, and, on the other hand to the refrigerant cooler and the refrigerant/coolant heat exchanger.

20 12. Air conditioning system for a motor vehicle, which is designed for an air conditioning operating mode and at least one other operating mode in the form of at least one of a heat pump operating mode and a reheat operating mode, said air conditioning system comprising:

a refrigerant cycle with a compressor, a refrigerant cooler and a supply air/refrigerant heat exchanger, said supply air/refrigerant heat exchanger being disposed in a supply air channel of a supply air conveying unit and functioning as an evaporator in an air conditioning operating mode,

wherein the supply air conveying unit exhibits two operating modes with opposite supply air conveying directions, and

wherein the air conditioning system is designed for carrying out a drying operating mode, in that the supply air conveying unit conveys drying air for drying the supply air/refrigerant heat exchanger in the air conveying direction, reversed to the supply air conveying direction leading into the vehicle interior, past the supply air/refrigerant heat exchanger, whereby the drying mode is activated at least after shutdown of the vehicle in a previous air conditioning or reheat mode.

13. Air conditioning system according to claim 12, wherein said refrigerant flow control valves include:

a 4 way valve which is connected with a first connection to the compressor output side, with a second connection directly or indirectly to the compressor inlet side and with a third connection to the supply air/refrigerant heat exchanger, and

a 3 way valve which is connected with a first connection with a fourth connection of the 4 way valve, with a

second connection to the refrigerant cooler and with a third connection to the refrigerant/coolant heat exchanger.

14. Air conditioning system according to claim 12, wherein the refrigerant cycle includes a refrigerant high pressure-sided accumulator with an assigned check valve arrangement operably connecting the accumulator to the supply air/refrigerant heat exchanger, the refrigerant cooler and the refrigerant/coolant heat exchanger.

15. Air conditioning system according to claim 12, wherein the refrigerant cycle includes:

a refrigerant low pressure-sided accumulator, and  
an internal heat exchanger which is arranged on a low pressure side between the accumulator and the compressor and on a high pressure side is connected, on the one hand, to the supply air/refrigerant heat exchanger, and, on the other hand to the refrigerant cooler and the refrigerant/coolant heat exchanger.

16. A method of operating an air conditioning system for a motor vehicle, which is designed for an air conditioning operating mode and at least one other operating mode in the form of at least one of a heat pump operating mode and a reheat operating mode, said air conditioning system comprising:

a refrigerant cycle with a compressor, a refrigerant cooler and a supply air/refrigerant heat exchanger, said supply



air/refrigerant heat exchanger being disposed in a supply air channel and functioning as an evaporator in an air conditioning operating mode,

5 a coolant cycle for cooling a heat generating vehicle component,

a refrigerant/coolant heat exchanger, coupling the refrigerant cycle and the coolant cycle so as to transfer heat,

10 refrigerant flow control valves for controlling mode-dependent flow of the refrigerant so as to be guided in an air conditioning mode from the compressor over the refrigerant cooler to the supply air/refrigerant heat exchanger, and

15 an internal combustion engine exhaust gas/coolant heat exchanger connected upstream in series to the refrigerant/coolant heat exchanger in the coolant cycle,

20 said method including controlling said refrigerant control valves to switch the air conditioning system between an air conditioning operating mode and the at least one other operating mode.

17. A method of operating an air conditioning system  
20 according to claim 16,

25 wherein said at least one other operating mode includes a reheat operating mode, in which the refrigerant flow control valves guide refrigerant flow from the compressor at least in part to the refrigerant/coolant heat exchanger, functioning as the condenser/gas cooler in this operating mode, and from there

to the supply air/refrigerant heat exchanger, functioning as the evaporator in this operating mode, and

wherein the refrigerant/coolant heat exchanger is connected upstream in series on the coolant side to a supply  
5 air/coolant heat exchanger disposed in the supply air channel.

18. A method of operating an air conditioning system according to claim 16,

wherein a supply air conveying unit for supplying air at the air supply channel exhibits two operating modes with opposite supply air conveying directions, and

wherein the air conditioning system is designed for carrying out a drying operating mode, in that the supply air conveying unit conveys drying air for drying the supply air/refrigerant heat exchanger in the air conveying direction, reversed to the supply air conveying direction leading into the vehicle interior, past the supply air/refrigerant heat exchanger, whereby the drying mode is activated at least after shutdown of the vehicle in a previous air conditioning or reheat mode.

19. A method of operating an air conditioning system for  
20 a motor vehicle, which is designed for an air conditioning operating mode and at least one other operating mode in the form of at least one of a heat pump operating mode and a reheat operating mode, said air conditioning system comprising:

a refrigerant cycle with a compressor, a refrigerant cooler and a supply air/refrigerant heat exchanger, said supply air/refrigerant heat exchanger being disposed in a supply air channel and functioning as an evaporator in an air conditioning operating mode,

a coolant cycle for cooling a heat generating vehicle component,

a refrigerant/coolant heat exchanger, coupling the refrigerant cycle and the coolant cycle so as to transfer heat, and

refrigerant flow control valves for controlling mode-dependent flow of the refrigerant so as to be guided in an air conditioning mode from the compressor over the refrigerant cooler to the supply air/refrigerant heat exchanger, and

said method including controlling said refrigerant control valves to switch the air conditioning system between an air conditioning operating mode and the at least one other operating mode,

wherein said at least one other operating mode includes a reheat operating mode, in which the refrigerant flow control valves guide refrigerant flow from the compressor at least in part to the refrigerant/coolant heat exchanger, functioning as the condenser/gas cooler in this operating mode, and from there to the supply air/refrigerant heat exchanger, functioning as the evaporator in this operating mode, and

wherein the refrigerant/coolant heat exchanger is connected upstream in series on the coolant side to a supply air/coolant heat exchanger disposed in the supply air channel.

5           20. A method of operating an air conditioning for a motor vehicle, which is designed for an air conditioning operating mode and at least one other operating mode in the form of at least one of a heat pump operating mode and a reheat operating mode, said air conditioning system comprising:

10           a refrigerant cycle with a compressor, a refrigerant cooler and a supply air/refrigerant heat exchanger, said supply air/refrigerant heat exchanger being disposed in a supply air channel of a supply air conveying unit and functioning as an evaporator in an air conditioning operating mode,

15           wherein the supply air conveying unit exhibits two operating modes with opposite supply air conveying directions, and

20           wherein the air conditioning system is designed for carrying out a drying operating mode, in that the supply air conveying unit conveys drying air for drying the supply air/refrigerant heat exchanger in the air conveying direction, reversed to the supply air conveying direction leading into the vehicle interior, past the supply air/refrigerant heat exchanger, whereby the drying mode is activated at least after shutdown of  
25           the vehicle in a previous air conditioning or reheat mode,

said method including switching the supply air conveying direction to and from the drying mode.